

4.3 Functional dependence of relations between agricultural business entities and banks

Agriculture is a credit-intensive industry. Without attracting credit resources, agricultural business entities simply cannot function normally. In countries with developed market economies, there is a specialized system of agricultural credit. The constant system of financial and credit support for the subjects of agrarian business of Ukraine is due to the specifics of agriculture (the duration of the production cycle, seasonality of production, low return on capital, high capital intensity, dependence on natural and climatic conditions, small sizes of agricultural business entities) and the desire to get out of such a protracted long-term agrarian crisis and the crisis of equivalent exchange as quickly as possible and with the least losses. The development of financial and credit support systems not only increases the creditworthiness of agricultural business entities, but also improves the system of adaptation of the economic mechanism of their functioning to market conditions.

In the relationship between the bank and the client, different situations may arise. If the bank is unable to continue financing needy agricultural business entities due to internal problems, then the agricultural business entity (like any other client) must be refinanced by other banks. But other banks may refuse to provide a loan due to ignorance of the quality of the projected production result. Under these conditions, the relations of an agricultural business entity with several banks reduce the likelihood of not achieving a result. To solve the problem of establishing the optimal number of relations with specific banks, the use of the appropriate probabilistic economic and mathematical model will help.

Consider the relationship with the bank on the example of such an agricultural business entity as an agricultural cooperative. Identifying the optimization of relations between the bank and the agricultural cooperative in the process of adaptation in market conditions of management, we took into account the results of research by scientists Balog A. [189], Beck T., Klappe, L.F., Mendoza J.C. [190], Gropp R., Gruendl C, Guettle, A. [191], Keleberda T. [192], Kostyrko I. G. [193], Leone P., Panetta I.C., Porrett, P. [194], Lien-Wen Lianga, Bor-Yi Huangb, Chih-Feng Liaob,

YuTing Gaob [195], Lupenko Yu. O. [196, 197,198], Malik M. Y. [197, 198, 199, 205], Mamchur V. A. [198, 200], Mesel-Veseliak V. Ya. [196], Nitani M., Riding, A. L. [201], Prilipko S. M. [202], Riding A.L., Haines, G. Jr. [203], Saito K., Tsuruta D. [204], Shpykuliak, O. H. [196, 197, 198, 205], Zander R., Miller C., Mhlanga N. [206] and others. The positions of researchers are extremely important, necessary in study, but not sufficient in the development of adaptation mechanisms for agricultural business entities and need constant improvement. The use of modeling tools in the relations between banks and agricultural business entities in moments of underdevelopment of adaptation mechanisms is extremely relevant. Simulation modeling expands the possibilities of using non-traditional analytical tools and acquires special weight in the diagnosis of the adaptive state. Own conceptual positions of the economic mechanism of adaptation, diagnostic analysis of the adaptive state, the results of research by domestic and foreign economists actualize the ability of cooperators - analysts to determine the optimality of relations between the bank and the agricultural cooperative in the process of adaptation.

The purpose of writing the article is to substantiate the optimality of relations between an agricultural cooperative as a subject of agrarian business and a bank in a market environment and to determine the essence of adaptation for agricultural cooperatives as operating subjects of agrarian business. The methods of formal logic, comparative analysis, simulation modeling and scientific cognition were used in the work.

The mechanism of adaptation functioning is determined by the level of involvement of the agricultural cooperative in the market environment. We believe that adaptation should be understood as a form of reflection by the current enterprise and its network structures of the mechanisms of influence of the market environment, seeking to establish an equilibrium in the relations and relations of the market. The main criterion for the mechanism of adaptation of agricultural cooperatives is to ensure creditworthiness. The optimality of relations between the bank and the agricultural cooperative facilitates and accelerates the development of economic mechanisms for adaptation in market conditions of management.

Banks are reliable financial intermediaries between the company and the market, and they specialize in obtaining information about customers. As is well known, the theory of bank-enterprise relations is based on two assumptions: 1) banks receive information about the quality of the enterprise and keep it secret from financial intermediaries; 2) enterprises take a loan from only one bank. Isolated relationships with banks prevail in the United States. In Japan, enterprises prefer to have closed banking connections. And, for example, in Italy, about 89% of enterprises have numerous relations with banks. Japanese banks act primarily in the interests of enterprises. Closed relations with informed creditors in Japan affect the investment decisions of enterprises, facilitate the prosperity of shareholders. Japanese banks have very strict control over their customers. For example, consider the study of internal acquisitions (unfunded Japanese firms were put up for acquisition by other firms on the TSE (Tokyo Stock Exchange)). Acquisitions of other enterprises are directly related to the quality of relations with the bank. Japanese firms in the process of domestic acquisitions received a positive income from transactions, and American in similar situations - zero income or negative.

In relations with more than one bank, small enterprises most often need it. According to the management of small businesses, relations with banks should be reliable and have a solid benefit. The bank receives information about the quality of the financial condition of the borrower for the possible receipt of rent. To cover all rental payments for an enterprise, it is enough to have a relationship with two banks. For businesses with high credit quality, the best relationship is with two lenders.

Suppose an agricultural business entity needs money to implement a production process or some financial project. Among the external investors there is a sufficient number of identical competitive banks. The situation of choosing the optimal number of relations with banks is simulated. The possibility of external non-bank financing is not included in the model according to the original plan. The period of the loan contract is taken into account. Let's also say that we are dealing with a risky subject of agricultural business (there is no money, but there is a desire to implement their project).

Suppose an agricultural business entity wants to implement its project, but is not very sustainable and does not have the means to implement it. From all possible external investors, the bank is chosen. Let's simulate the probability of choosing the optimal number of relations with banks.

Let the implementation of the project consist of three stages. To implement the first stage of the cooperative at the initial point in time t_0 is forced to borrow an amount from the bank ψ_0 . At a subsequent intermediate point in time ψ_1 the cooperative reports to the bank for the results of the first loan and acquires the opportunity to acquire secondary capital ψ_1 . From the cooperative, banks predict to receive a payment $x \times H$ at a time ψ_2 , where is X – share of capital from the agricultural cooperative for the bank at a time $t=1$, H – income from the implementation of the investment project.

The cooperative needs to remember that with the growing number of relations with banks, the share X Reduced. In addition, at a time $t=0$ reducing the number of relationships with banks reduces the riskiness of relations at the time of probable refinancing $t=1$. A bank's loan portfolio can also be risky.

Let at a moment in time $t=1$ agricultural cooperative takes out a loan $D + \psi_1$, where is $D = \psi_0 + m \times \rho$ – interest and principal repayment of the loan or the required loan amount to cover costs, m – number of banks, ρ – fixed cost of the bank in the loan process.

If an agricultural cooperative has contacted an uninformed bank, the cooperative will take out a loan in the following situations: 1) banks informed about this cooperative are no longer active, let's indicate the probability of this φ^m ; 2) the percentage of an uninformed bank about the cooperative is more profitable than the percentage of at least one active of the informed, let's indicate the probability of this

$$(1 - \varphi^m) \times F\left(\frac{1}{G}\right); G < G^i = \frac{1}{p}.$$

If the bank is informed about the cooperative (about the creditworthiness of the cooperative) and provides a loan, then the condition for obtaining a possible zero profit can be expressed as follows:

$$p_{\min} (G^i (D + \psi_1), x \times H) - (D + \psi_1) = 0.$$

Banks will refinance the project if $p \geq \frac{D + \psi_1}{x \times H}$. Then the break-even percentage

is determined $G^i = \frac{1}{p}$.

The success of the project investment can be expressed in the following way:

$$Y^u(p|G) = \frac{\varphi^m \times Y(p) + (1 - \varphi^m) \times \int_{\frac{1}{G}}^{\frac{1}{G}} p \cdot f(p) \cdot dp}{\varphi^m + (1 - \varphi^m) \times F\left(\frac{1}{G}\right)} \quad (1)$$

For uninformed agricultural cooperatives as borrowers, a necessary and sufficient condition for refinancing at a time $t = 1$ is as follows:

$$G^* \times (D + \psi_1) \times Y^u \times (p|G^*) - (D + \psi_1) \geq 0 \quad (2)$$

The loan is paid to the co-operative in the first stage if condition (2) is met with probability $p = 1$. Condition (2) will be met when $D = \psi_0 + \rho$ и $m = 1$. But in the moment $t = 0$ An agricultural cooperative has the right to expect a profit, which is quite logically expressed as follows:

$$\xi(m) = Y(p) \times H - (\psi_0 + m \times \rho + \psi_1) \times \left(G^u \times \varphi^m \times Y(p) + (1 - \varphi^m) \times \left(G^u \times \int_{\frac{1}{G^u}}^{\frac{1}{G^u}} p \cdot dF(p) \right) \right) \quad (3)$$

$$G^u = \frac{1}{Y^u \times (p|G^u)}$$

Given (1) and (2), we transform the expression (3) and finally have:

$$\xi(m) = Y(p) \times H - (\psi_0 + \psi_1 + m \times \rho).$$

From the bank's point of view, it will be profitable to provide a loan to an agricultural cooperative if $p \geq \frac{1}{G^*}$. But if $\frac{1}{G^*} < p < \frac{\psi_1}{x \times H}$, then it is not profitable for

the bank to refinance the project. If $p \times x \times H \triangleleft \psi_1$, for a cooperative this means that it is better to close the project altogether.

Suppose that an agricultural cooperative maintains relations with several creditors (banks), and the loan can be divided into equal proportions. In this case, each bank has the right to expect profit, expressed as follows:

$$\left((1 - \varphi^m) \times \left(1 - F\left(\frac{1}{G^*}\right) \right) \right) \times \left(\frac{D}{m} \right) - \left(\left(\frac{\psi_0}{m} \right) + \rho \right) = 0.$$

Let's convert this expression to the following form:

$$\psi_0 + \rho \times m = (1 - \varphi^m) \times \left(1 - F\left(\frac{1}{G^*}\right) \right) \times D \quad (4)$$

And this means that the agricultural cooperative at a time $t = 0$ can predict profit in the following form:

$$\xi(m) = (1 - \varphi^m) \times \left(\int_{\frac{\psi_1}{x \times H}}^{t=0} (p \times H - \psi_1) \times f(p) \times dp - \left(1 - F\left(\frac{1}{G^*}\right) \right) \times D \right).$$

Convert this expression to reflect expression (4). Finally we have:

$$\xi(m) = (1 - \varphi^m) \times \left(\int_{\frac{\psi_1}{x \times H}}^{t=0} (p \times H - \psi_1) \times f(p) \times dp \right) - (\psi_0 + \rho \times m).$$

In the event that banks are not aware of the cooperative at a time $t = 1$ the project is not refinanced, the number of optimal relations with the bank for the cooperative can be expressed as follows:

$$m^* = \frac{\ln \rho - \ln(-S \times \ln \rho)}{\ln \varphi},$$

$$\text{where is } S = \int_{\frac{\psi_1}{x \times H}}^{t=1} (p \times H - \psi_1) \times f(p) \times dp \quad (5)$$

Condition (2) essentially distinguishes the isolation of banking relations. Let $T(x, H, \varphi, \psi_0, \psi_1)$ – the left side of the condition (2). To prove our assumptions, we

will prove that the function T increments in arguments φ, x, H and decreases in arguments ψ_0, ψ_1 .

Suppose that $q = \frac{(\psi_0 + \psi_1 + \rho)}{x \times H}$. It logically follows that

$$\frac{\partial T}{\partial \varphi} \Big|_{m=1} = \left(\frac{1}{q} \right) \times \left(Y(p) - \int_{p_t}^q p \times f(p) \times dp \right) - 1 + F(q).$$

This means that $\frac{\partial T}{\partial \varphi} \Big|_{m=1} = \int_q^1 \left(\frac{p}{q} - 1 \right) \times f(p) \times dp$, and this expression is always

greater than 0. To show growth T in X , it is enough to show that T decreases in q .

It should be noted that through q in T includes x, H, ψ_0, ψ_1 and T increases in ψ_0 and ψ_1 , and decreases in X and H . Let's define a derivative of T along Q so:

$$\frac{\partial T}{\partial q} \Big|_{m=1} = \left(\frac{1}{q^2} \right) \times \left(q^2 \times (1 - \varphi) \times f(q) - \left(\varphi \times Y \times p + (1 - \varphi) \times \int_{p_t}^q p \times f(p) \times dp \right) \right) - f(q) \times (1 - \varphi).$$

This leads to a statement with a negative sign:

$$\frac{\partial T}{\partial q} \Big|_{m=1} = - \left(\frac{1}{q^2} \right) \times \left(\psi \times Y \times p + (1 - \psi) \times \int_{p_t}^q p \times f(p) \times dp \right).$$

In other words, if the refinancing of the project is implemented quite enough by one knowledgeable bank, then the presence of numerous relations with banks ($\triangleright 2$) they will not be profitable for agricultural cooperatives. But if the bank is not going to refinance the project, then the optimal number of relations is determined by the expression (5).

The more profitable the project, the greater the losses from its possible premature liquidation of project financing and the more profitable are the relations with several banks. In the sphere of numerous relations with banks, the optimal number of relations increases depending on the quality of the loan collection mechanism and on the probability of a secondary investment of the project. On the other hand, if agricultural business entities expand ties in the field of numerous relations with banks, then for

banks with an unimportant financial condition, the probability of stopping financing the project increases.

Some agricultural business entities that have retained their viability are based on separate relations with banks. Suppose a bank refuses to refinance a project; other banks, with which the agricultural business entity has not previously maintained relations, also do not want to participate in refinancing; in such a situation, the services of the union "agrarian business entity + banks" should be offered. The most common are numerous relationships between banks among medium and small agricultural business entities. Agricultural business entities that prefer to have relations only with large banks are not afraid of relations with several banks at the same time. Agribusiness entities that maintain relations with small banks tend to use separate relations with the bank.

Functional dependence (5) is implemented on the example of agricultural business entities of the Sumy region of Ukraine in 2021. Among the agricultural cooperatives of the Sumy region of Ukraine, 73,61% maintain relations with two banks as optimal at the same time. 26,38% of agricultural cooperatives are un adapted in market conditions. Among the un adapted agricultural cooperatives, only 4.1% of enterprises have relations with two banks.

Determining the optimality of relations between the bank and the subject of agricultural business contributes to the development of adaptation processes. Simulation tools strengthen the methodology for diagnosing the adaptive state of agricultural business entities in market conditions. The revival of credit cooperation is also one of the options for improving the financing of agricultural business entities. The provision of preferential bank loans is a good support of the state. Beneficiation of interest by subsidizing both customers and banks realizes the possibility of obtaining a loan at low interest rates (as is done in developed countries).

The process of revival of credit cooperation in Ukraine continues. The foundation of the national system of credit cooperation was laid. For the further development of financial and credit support for agricultural business entities, an integrated approach to improving the credit infrastructure, settlement and credit

mechanisms is necessary. It is necessary to expand the scope of use of leasing (forms of long-term loan), to form a mortgage loan system (land is a means of obtaining credit and investment resources), to develop special credit organizations (guarantee and collateral funds).

Thus, in the course of the study, it has been established, that adaptation is a form of reflection by the current subject of agrarian business and its network structures of the mechanisms of influence of the market environment, which seeks to establish equilibrium in relations and relations of the market. Identification of the state of functional structures of the current subject of agrarian business and adaptive forms of functioning is associated with the diagnosis of the adaptive state. The functional relationship between ensuring creditworthiness and optimality of relations between the bank and the cooperative as an agricultural business entity enriches not only the analytics of agricultural cooperation, but is also the main criterion for adaptation in the market environment. The methodology of the economic mechanism of adaptation involves the use of non-traditional analytical tools and contributes to the development of institutional transformations in the country. The revealed functional dependence of determining the optimal number of relations between the bank and the agricultural cooperative is ready for applied use in the diagnosis of the adaptive state of agricultural business entities.